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(71) Applicant *(for all designated States except US)*: BLUE AIR AB [SE/SE]; Danderydsgatan 11, S-114 26 Stockholm (SE).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: WENNERSTRÖM, Johan [SE/SE]; Ebba Brahes väg 9B, S-192 69 Sollentuna (SE).

(74) Agent: ERIKSSON, Kjell; Norrtelje Patentbyrå AB, P.O. Box 38, S-761 21 Norrtälje (SE).

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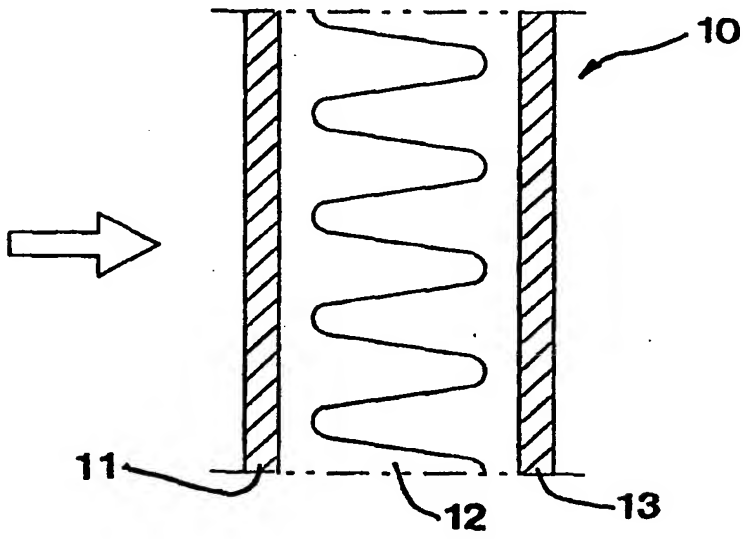
(57) Abstract

The invention relates to a device in connection with an electrostatic filter for air purifying, said filter including an ionizing portion (1) and a precipitating portion (2). The precipitating portion (2) consists of a unit (10) that is composed of at least one non-conductive or partly conductive air permeable layer (12), provided between at least two proximate, conductive or partly conductive, air permeable layers (11, 13), one (11) of said layers having a higher potential than the other (13), an electrical field being present between the layers (11, 13) in order to collect particles in an air stream that is transported through the precipitating portion (2).



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DEVICE IN CONNECTION WITH AN ELECTROSTATIC FILTER

The present invention relates to a device in connection with an electrostatic filter for air purifying, said filter including a ionizing portion and a precipitating portion.

An electrostatic filter is usually composed of two portions, i.e. an ionizing portion where particles are charged, said particles being transported by an air stream through the filter, and a precipitating portion where the charged particles are separated from the air. The ionizing portion may consist of a corona wire located between two target electrodes, a high voltage potential is applied to the corona wire and a lower potential to the target electrodes. At a sufficient high potential applied to the wire a so called corona discharge occurs around said corona wire. At this discharge ions are released from the wire and said ions find their way to the target electrodes. The precipitating portion normally consists of parallel plates, i.e. a so called precipitator, and every second plate has high voltage potential and every second low. This generates an electrical field between the plates. A particle carried by the air through the filter passes initially the ionizing portion and then collides with one or more ions and is thus charged. When the charged particle passes the precipitator it is affected by the electrical field and its path is curved towards one of the plates and is deposited upon said plate. The benefit of these filters is low pressure drop and high separation degree for small particles. The disadvantage on the other hand is a complicated structural design, low dust collecting ability, i.e. short service intervals, and that large, i.e. heavy particles may pass directly through without being separated.

As regards mechanical filters it is meant in this connection a filter that "screens" the air passing through the filter. The filter media often consists of a porous bed of fibres of e.g. glass or syntetic material. Among other things the diameter of the fibres and the density between the fibres are determinant for the performance of the filter. Generally small fibres having small space between the fibres result in a filter media that has high separation degree for small particles. However, the pressure drop across the filter media

increases by increased density. The advantage with this type of filter is high dust collecting ability and high separation degree but the disadvantage is high pressure drop.

As regards electret filters is meant a mechanical filter as defined above with the difference that the fibres have a "permanent" charging. The consequence of this is that a relatively coarse filter having thick fibres and consequently low pressure drop may separate small particles, if said particles have a low charging. The charging of the fibres decline eventually and the performance of the filter also declines. The advantages with this type of filter is a high initial separation degree and relatively low pressure drop but the disadvantages is that the separation degree declines after a certain time of use.

The aim of the present invention is to provide a device in connection with an electrostatic filter, said device eliminating the disadvantages of the above mentioned, previously known filters. The characterising features of the invention are defined in the appended claims.

Thanks to the device according to the present invention a filter has been provided that in a proper way realises its aims and is simultaneously simple and cheap to manufacture. The electrostatic filter for air purifying according to the invention is composed of an ionizing portion and a precipitating portion, where the ionizing portion may be designed in a conventional way by e.g. a corona wire or a coal fibre brush or the like and where the ionizing may be located directly adjacent to the precipitating portion, this is however not necessary. In the structural design of the precipitating portion there is a non-conductive or to a certain degree air permeable layer located between two conductive or partly conductive air permeable layers. One of the conductive layers are kept at a higher potential than the other, whereby an electrical field is generated between said layers, and thus a charged particle that is carried by an air stream through the filter is affected by the electrical filter between the two conductive layers. The path of the particle is then irregular and the particle adhere to the layer. The advantage of this filter design is that a simple coarse filter

medium may be used for separating small particles. The filter medium may be washable and e.g. constitute of a polyester foam having open pores. Further advantages are that there is a low pressure drop across the filter compared to mechanical filters and electret filters and high separation degree and high dust collecting ability compared to electrostatic filters and a simple design and consequently simple manufacturing.

The invention is described more in detail below by the aid of a preferred embodiment and reference to the enclosed drawings, where

Figure 1 shows a schematic view of a previously known two-step electrostatic filter including an ionizing portion and a precipitating portion;

Figure 2 shows a precipitating portion according to the present invention, that may correspond to the precipitating portion in figure 1; and

Figure 3 shows an alternative embodiment of the precipitating portion disclosed in figure 2 including a filter designed in several layers, i.e. including four layers of filter media and five conductive layers.

In figure 1 is shown a schematic view of a previously known electrostatic filter for air purifying. The filter is composed of an ionizing portion 1 and a precipitating portion 2. The ionizing portion 1 may be constituted of a corona wire 3 located between two target electrodes 4 and 5. A high voltage potential may be applied to the corona wire and a lower potential to the target electrodes 4, 5, a corona discharge occurs at a sufficient high potential applied to the wire 3. During this discharge ions are released from the wire 3 and said ions find their way to the target electrodes 4 and 5. The precipitating portion 2 normally constitutes of parallel plates, so called precipitators, where every second plate 6, 8 has a high voltage potential and every second plate 7, 9 has a low voltage potential, this generating an

electrical field between the plates. A particle that by an air stream is carried through the filter passes initially the ionizing portion 1 and collides with one or more ions and is consequently charged and, when said particle passes the precipitating portion 2, it is affected by the electrical field and its path is curved towards one of the plates for deposition upon said plate.

The filter according to the present invention may be designed according to figure 1 having an ionizing portion 1 and a precipitating portion 2, where the ionizing portion may be designed in the shown conventional way with a corona wire 3 or a coal fibre brush but the ionizing portion must not be located in close proximity to the precipitating portion 2. The precipitating portion 2 is however designed as is shown more in detail in figure 2, where this portion consists of a unit 10 that is composed of at least one non-conductive or partly conductive air permeable layer 12 provided between two adjacent, conductive or partly conductive, air permeable layers 11, 13, one layer 11 having a higher potential than the other layer 13, and that an electrical field is present between the layers 11, 13 in order to have a charged particle that is transported by an air stream through the filter affected by said electrical field between said two conductive layers 11, 13, said path of the article through the layer 12 being irregular and the particle adhering to said layer.

The conductive or partly conductive layers 11, 13 may be designed in several ways. They may consist of grilles or metal wires, expanded metal, applied, conductive fibres of different conductive materials and so on. The layer 12 may consist of different materials and have different structures. It may consist of a mechanical filter medium manufactured from fibres of glass or plastic, foam materials having open pores and so on.

The filter unit 10 according to the invention may also be designed having several layers as can be seen from figure 3. In said figure a filter is disclosed having four layers, as filter media conductive layers 14-17 and five conductive layers 18-22 adjoining said layers 14-17, every second 18, 20,

22 of the conductive layers having a higher potential than the rest of the layers 19 and 21.

The non-conductive or semi-conductive layers may also consist of a material that simultaneously serves as a deposition surface for particles and for reduction of gases in the air. The material in the layer may in such cases e.g. consist of fibres of activated carbon. The filter according to the invention may be voltage-fed either in an "active way" or in a "passive way". By active way is meant direct coupling of the layers 11, 13 or 18-22 to a voltage source. By passive way is meant that the layers 11, 13 or 18-22 are charged by the upstream ionizing portion. The first layer upstream of the filter may then serve as target electrode for the ionizing portion.

According to an alternative embodiment of the invention at least one of the conductive or partly conductive air permeable layers 11, 13:'; 18, 19, 20, 21, 22 may include a gas adsorbing material, preferably activated carbon. By such an arrangement the effect is achieved that apart from particle separation of the air passing through the filter 12/the filters 14, 15, 16, 17 also a separation of gaseous pollutions takes place. By designing both the conductive and partly conductive air permeable layers 1, 13; 18, 19, 20, 21, 22 to include a gas adsorbing material, i.e. the layers located on both sides of the filter 12/filters 14, 15, 16, 17 the separation degree and capacity as regards gaseous pollutions are increased.

Also by this alternative embodiment, i.e. when thus the conductive or partly conductive, air permeable layers 11, 13; 18, 19, 20, 21, 22 preferably include activated carbon said layers may be designed in a way that is described on top of page 5, i.e. such a grille may be coated with activated carbon. It should especially be mentioned that when the filter 12/the filters 14, 15, 16, 17 consist of a so called coarse filter medium, activated carbon may be applied to said coarse filter medium, e.g. by having the coarse filter medium dipped into a suspension of activated carbon in powder form, adhesive and water. Thus both sides of the coarse filter medium is normally coated with activated carbon. If it is wished that

only one side of the coarse filter medium is coated with activated carbon alternative coating techniques may be used.

Claims

1. Device in connection with an electrostatic filter for air purifying, said filter including an ionizing portion (1) and a precipitating portion (2), c h a r a c t e r i z e d in that the precipitating portion (2) consists of a unit (10) that is composed of at least one non-conductive or partly conductive air permeable layer (12), provided between at least two proximate, conductive or partly conductive, air permeable layers (11, 13), one (11) of said layers having a higher potential than the other (13), an electrical field being present between the layers (11, 13) in order to collect particles in an air stream that is transported through the precipitating portion (2).

2. Device according to claim 1, c h a r a c t e r i z e d in that the conductive layers (11, 13) consist of grilles or metal wires, expanded metal, applied fibres of different conductive materials.

3. Device according to claim 1, c h a r a c t e r i z e d in that the precipitating portion (2) includes four layers (14-17) serving as filter medium and five conductive layers (18-22) adjoining said filter medium layers (14-17), every second (18, 20, 22) of said conductive layers having higher potential than the rest of the layers (19, 21).

4. Device according to anyone of the preceding claims, c h a r a c t e r i z e d in that the non-conductive or partly conductive layer (12, 14-17) has a mechanical filter medium manufactured from glass or plastic or from a foam material having open pores.

5. Device according to anyone of the preceding claims, c h a r a c t e r i z e d in that the precipitating portion (2) is fed in an active way by direct coupling to the layers (11, 13, 18-22) to a voltage source or is fed in a passive way by charging from the upstream ionizing portion.

6. Device according to anyone of the claims 1-5, c h a r a c t e r i z e d in that at least one of the conductive or partly conductive, air permeable layers (11, 13) include a gas adsorbing material.

7. Device according to claim 6, c h a r a c t e r i z e d in that the gas adsorbing material consists of activated carbon.

8. Device according to claim 7, c h a r a c t e r i z e d in that the activated carbon is in powder form, that in suspension is applied to the non-conductive or partly conductive, air permeable layer (12).

Fig 1

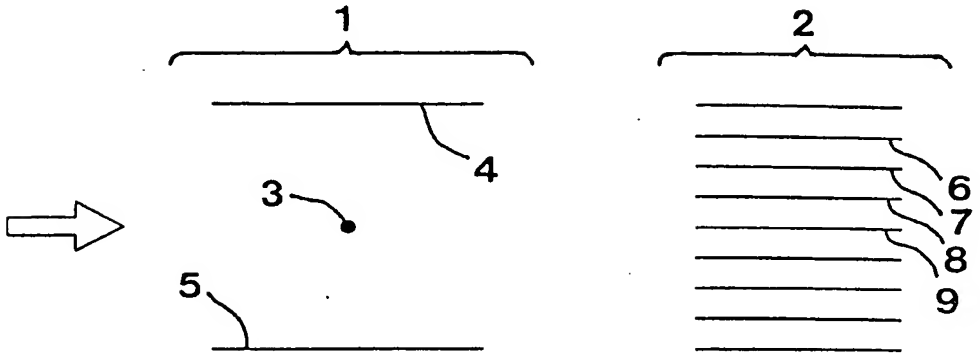


Fig 2

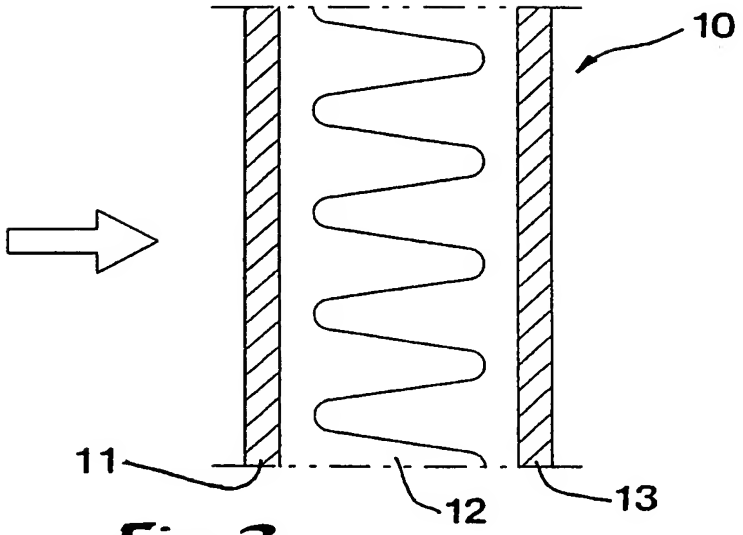
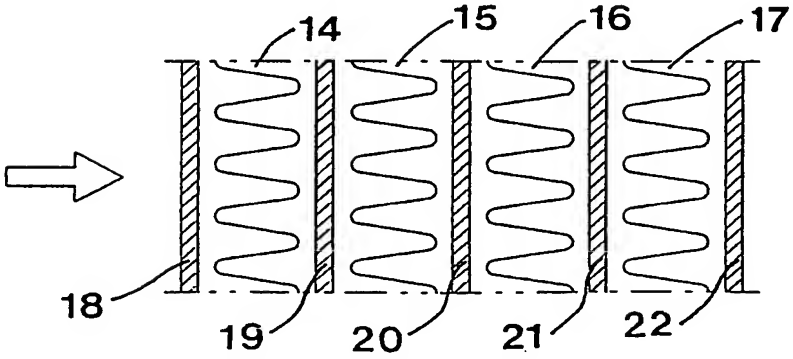


Fig 3



INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 97/01950

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B03C 3/155
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B. FIELDS SEARCHED

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IPC6: B03C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9311876 A1 (YAMAMOTO, YUJIRO), 24 June 1993 (24.06.93), page 5, line 14 - page 7, line 11	1-5
Y	--	6-8
X	US 2822058 A (WILLIAM J. ROOS ET AL), 4 February 1958 (04.02.58), figure 1, claims 1,2	1,2,4,5
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X	US 3800509 A (ALLAN W. CARR ET AL), 2 April 1974 (02.04.74), column 1, line 35 - line 49, figure 11	1,2,4,5
	--	
Y	US 5108470 A (WILLIAM PICK), 28 April 1992 (28.04.92), claims 3,4, abstract	6-8
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

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